

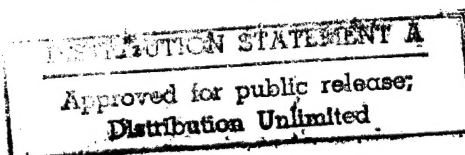
PREFINAL REPORT
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
FOR
BOILER AND CHILLER PLANTS
AT
FORT MONMOUTH, NEW JERSEY

PREPARED FOR
U.S. ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT

UNDER
CONTRACT NO DACA-65-86-C-0101

PREPARED BY
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MAY 1988



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1.0 AUTHORIZATION

The Energy Engineering Analysis Program (EEAP) for selected boiler and chiller plants at Fort Monmouth was authorized by the Department of the Army, Corps of Engineers, Norfolk, Virginia, under Contract No. DACA65-86-C-0102 dated September 11, 1986 and subsequent Modification No. P00001 dated April 2, 1987.

2.0 OBJECTIVES OF THE STUDY

The objectives of this study are as follows:

- a. Perform an energy audit of selected boiler and chiller plants.
- b. Review, use and incorporate applicable data and results of related energy conservation studies, past and current.
- c. Perform a site survey to insure that all methods of energy conservation which are practical have been considered.
- d. Identify all Energy Conservation Opportunities (ECOs), including low cost/no cost ECOs, and perform a complete evaluation of each.
- e. Prepare programming documentation for all Energy Conservation Investment Program (ECIP) projects (DD Form 1391, Life Cycle Cost Analysis Summary Sheet with backup calculation and Project Development Brochure (PDB)).
- f. Prepare implementation documentation for all justifiable ECOs.
- g. List and prioritize all recommended ECOs.
- h. Prepare a comprehensive report which will document the work accomplished, the results and the recommendations.

3.0 SUBMISSION REQUIREMENTS

As outlined in the contract, included in Volume II, Appendix A, the study is divided into three major submissions:

- a. Interim Submittal
- b. Prefinal Submittal
- c. Final Submittal

4.0 WORK ACCOMPLISHED

Field surveys of boiler plants were carried out during the week of December 1, 1986, field surveys of steam and condensate distribution systems were carried out during the week of April 20, 1987 and the field surveys of chiller plants were performed during the week of July 27, 1987.

During the field surveys, a team of Syska & Hennessy carried out tests, observations, and interviews with Department of Engineering and Housing (DEH), operating and maintenance personnel, and various Building personnel. The operation and maintenance of all the boiler and chiller plants at Fort Monmouth is performed by an outside company under a contract.

Entrance and exit meetings were held with DEH personnel to discuss survey strategy work progress and obtain support information. As decided during the Entrance Meeting, the Interim Report with only Boiler Plants Energy Audit was submitted on June 15, 1987. Subsequently on July 15, 1987 an Interim Report with only Steam and Condensate Distribution System Energy Audit was submitted. Per comments from reviewers these two submittals were combined with the Chiller Plants Energy Audit and the combined Interim Submittal was submitted on November 6, 1987. The Interim Submittal Review Meeting was held in DEH offices at Fort Monmouth on February 10, 1988. The comments of the reviewers and the minutes of the meeting are included in Volume III, Appendix A.

This report consists of four volumes. The first volume is an Executive Summary, second volumes consists of narrative report describing in detail what was accomplished and the results of this study. The third volume includes appendices, detailed calculations and all back-up material. The fourth volume consists of programming and implementation documentation.

A prefinal review conference will be held at Fort Monmouth to review comments on this submittal. The review comments will be incorporated as revised pages, making the Prefinal Report into a Final Report, which will then complete the contract.

5.0 FACILITY DESCRIPTION

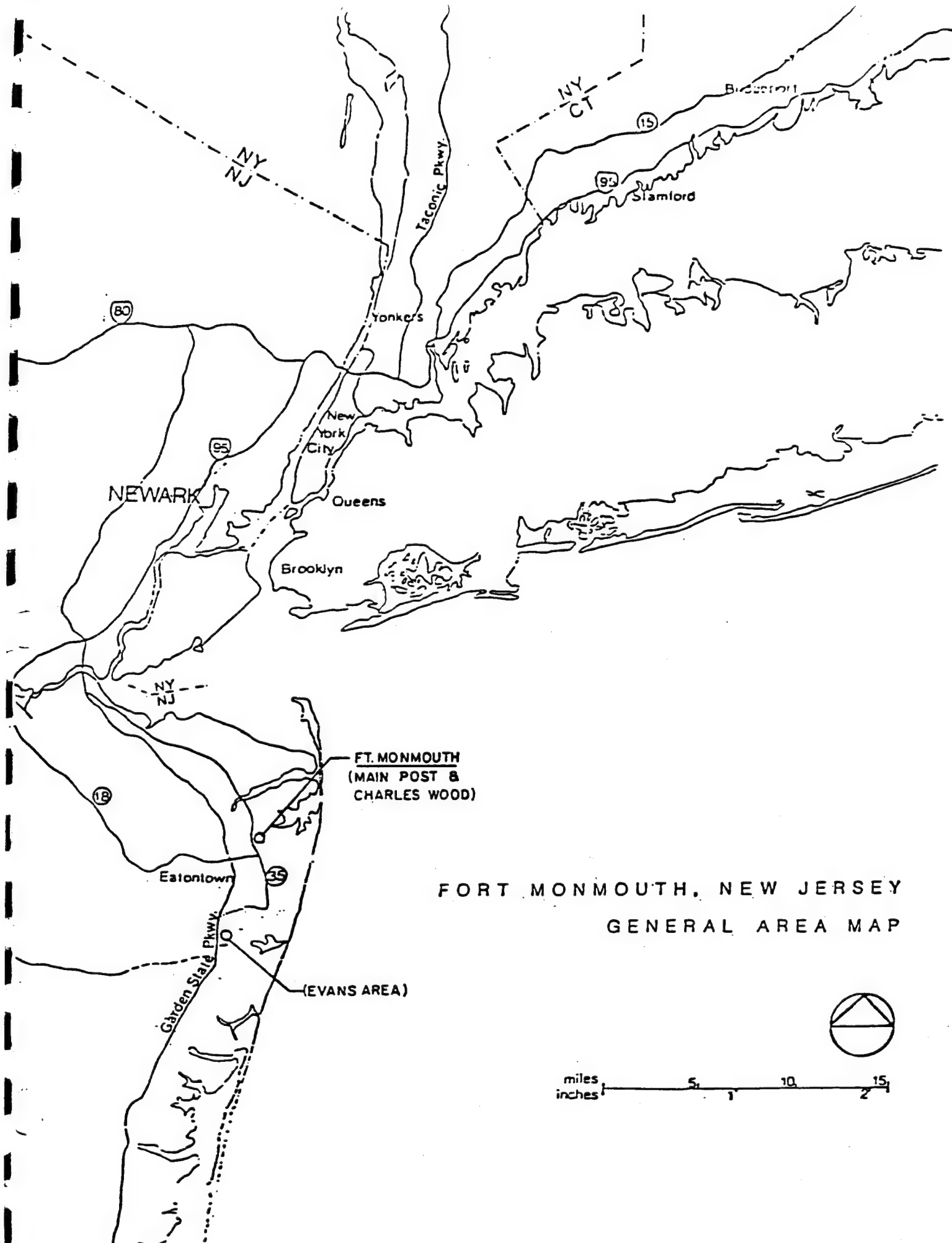
Fort Monmouth is a U.S. Army Material Development and Readiness Command (DARCOM) installation located in Monmouth County, New Jersey. The installation is located approximately 45 miles southwest of New York City.

Fort Monmouth provides command, administrative and logistical support for Headquarters, U.S. Army Electronics Command. Seven major activities are located at or near Fort Monmouth; they are: the Army Electronics Command (ECOM), the US Military Academy Preparatory School, the Army Communications Office (TRI-TAC), the Army Satellite Communications Agency, the Army Communications Command Agency, the Health Service Command, Medical Department Activities, and Paterson Army Hospital.

The base consists of three areas: the Main Post, the Charles Wood Area, and the Evans Area.

There are about 610 buildings located on these areas of the base.

Majority of the buildings have dedicated boiler and/or chiller plants.



FORT MONMOUTH, NEW JERSEY
GENERAL AREA MAP

6.0 PRESENT ENERGY CONSUMPTIONS

Majority of energy consumption at Fort Monmouth is electricity and fuel oil No. 2. Small amounts of natural gas and fuel oil No. 6 are also utilized at the facility.

The electricity used at the facility comes from Jersey Central Power and Light Company via the main substation and post grid of Fort Monmouth.

Ft. Monmouth is subject to billing under service classification GP-General Service Primary. The rate structure as of 12 November 1985 contains the following main provisions:

Customer Charge Per Month:	\$125.00
Demand Charge Per kW:	\$10.33 June - October \$ 9.33 November - May
Energy Charge Per kWh:	\$0.0709 On-Peak* \$0.0558 Off-Peak*
Kilovolt-Ampere Charge:	\$0.60 per kVa
Energy Adjustment Charge (EAC):	All kWh supplied is subject to Energy Adjustment Clause (Rider EAC). (Average EAC = \$0.0045/KWH).

*On-peak time, 0800 to 2000 - Monday through Friday.
Off-peak time - remaining hours.

Fuel Oil No. 2 and No. 6 are purchased from local suppliers and delivered by trucks to boiler plants, fuel oil storage tanks and individual buildings throughout the Main Post, Charleswood Area and Evans Area.

Natural gas for the facility is purchased from New Jersey Natural Gas Company and is distributed through the base by means of government owned gas lines.

7.0 HISTORICAL ENERGY CONSUMPTIONS

The annual energy consumptions* for FY 85, 86 and 87 are shown in the table below.

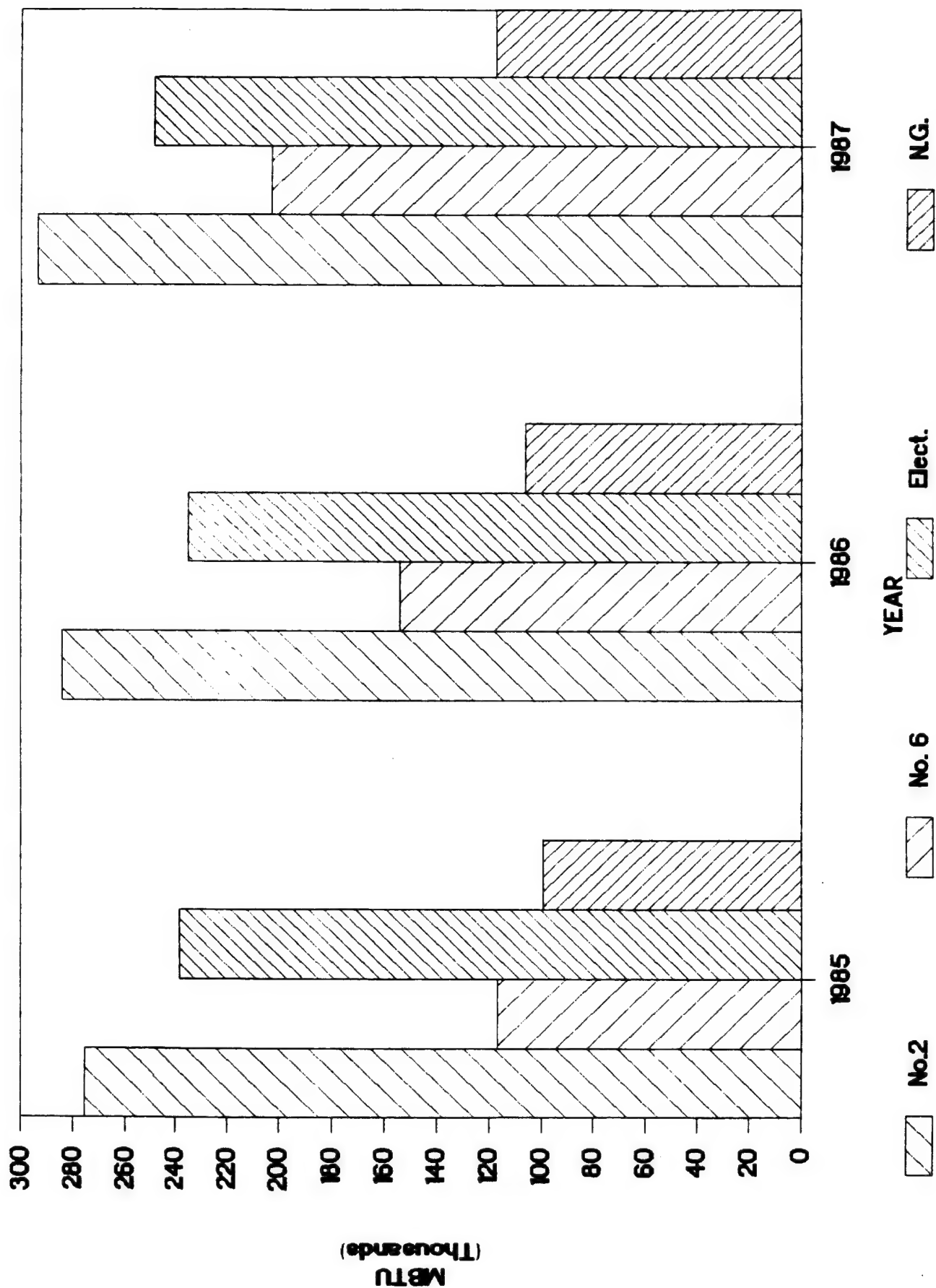
Year	Fuel Oil No. 2 (Gals)	Fuel Oil No. 6 (Gals)	Natural Gas (Therms)	Electricity (kwh)
1985	1,984,955	781,582	963,367	69,835,602
1986	2,050,100	1,028,800	1,030,508	68,672,737
1987	2,117,383	1,354,214	1,135,712	72,669,763

* The energy consumption figures are obtained from DEH.

The energy conversion factors used in the study were as follows:

Electricity: 1 kwh = 3413 Btu
Fuel Oil No. 2: 1 Gallon = 138,700 Btu
Fuel Oil No. 6: 1 Gallon = 149,700 Btu
Natural Gas: 1 therm = 103,100 Btu

HISTORICAL ENERGY CONSUMPTION



8.0 ENERGY CONSERVATION ANALYSIS

A total of 14 ECOs were evaluated to determine potential energy savings and operating cost savings. Based upon estimated construction costs, life cycle economics were evaluated. The results are summarized in Table 8.1 below. Table 8.2 lists the Prioritized Summary of all ECOs and Table 8.3 lists the Prioritized Summary of recommended ECOs.

Port Monmouth Table 8.1
Summary of Studied Energy Conservation Opportunities (ECOs's)

Summary of Studied Energy Conservation Opportunities (cont.)

ECO No.	ECO Name	SIR	Simple Amortization Period	Electricity	Annual Savings					Total Investment
					Fuel Oil	Natural Gas	Total Energy	Cost		
									Mo. 2	
			(yr)	(kWh)	(gal)	(ccf)	(MBtu)	(\$)	(\$)	
5.3.1	Replace Boilers	2.67	5.40	-	17,110	57,491	1,496	11,129.0	59,555	684,486
5.3.2	Replace Burners	0.12	68.00	-	425	-	-	59.0	379	23,297
5.3.3	Install Oxygen Trim Controls	0.18	43.00	-	425	-	-	59.0	379	15,030
5.3.4	Reduce Make-up Water Quantities	0.68	23.40	-	19,150	-	-	2,867.0	14,476	428,189
5.3.5	Install Blowdown Heat Recovery	3.46	4.90	-	838	7,680	-	1,266.0	6,553	30,881
5.3.6	Insulate Piping	27.35	0.67	-	4,036	7,357	310	1,692.0	9,334	5,594
5.3.7	Provide Summer Boiler	4.59	3.70	-	-	56,610	-	8,479.0	42,787	151,671
5.3.8	Repair Steam Leak	27.64	0.66	-	2,314	6,865	-	1,344.0	7,254	4,287
5.3.9	Repair Steam Trap	63.18	0.29	-	6,705	18,470	-	3,695.0	19,943	5,157
5.4.1	Provide Pump Shut-off	3.68	2.80	9,087	-	-	-	31.0	700	1,741
5.4.2	Provide Free Cooling Cycle	2.30	5.40	81,284	-	-	-	277.4	6,259	32,451
5.4.3	Install Compressors	5.54	2.30	91,489	-	-	-	312.3	7,045	15,157
5.4.4	Install High Effici. Motors	10.12	1.30	2,742	-	-	-	9.36	210	248
5.4.5	Insulate CHW Piping	2.46	5.40	1,638	-	-	-	5.58	126	608

Port Monmouth Table 8.2

SIR Prioritized Summary of Studied Energy Conservation Opportunities (ECO's)

ECO No.	ECO Name	SIR	Simple Assumption Period	Electricity	Annual Savings						Total Investment	
					(yr)	(kWh)	Fuel Oil		Natural Gas	Total Energy		Cost
							(gal)	(gal)				
					(gal)	(gal)	(ccf)	(MBtu)	(\$)	(\$)		
5.3.9	Repair Steam Trap	63.18	0.25	-	-	6,705	18,470	-	3,695.0	19,943	5,157	
5.3.8	Repair Steam Leak	27.64	0.66	-	-	2,314	6,865	-	1,344.0	7,254	4,287	
5.3.6	Insulate Piping	27.35	0.67	-	-	4,036	7,357	310	1,692.0	9,334	5,594	
5.4.4	Install High Effici. Motors	10.12	1.30	2,742	-	-	-	-	9.36	210	248	
5.4.3	Install Compressors	5.54	2.30	91,489	-	-	-	-	312.3	7,045	15,157	
5.3.7	Provide Summer Boiler	4.59	3.70	-	-	-	56,610	-	8,479.0	42,797	151,671	
5.4.1	Provide Pump Shut-off	3.68	2.80	9,087	-	-	-	-	31.0	700	1,741	
5.3.5	Install Blowdown Heat Recovery	3.46	4.90	-	-	838	7,680	-	1,266.0	6,553	30,881	
5.3.1	Replace Boilers	2.67	5.40	-	-	17,110	57,491	1,496	11,129.0	59,555	684,486	
5.4.5	Insulate CHW Piping	2.46	5.40	1,638	-	-	-	-	5.58	126	608	
5.4.2	Provide Free Cooling Cycle	2.30	5.40	81,284	-	-	-	-	277.4	6,259	32,451	
5.3.4	Reduce Make-up	0.68	23.40	-	-	19,150	-	-	2,467.0	14,476	428,189	
5.3.3	Install Oxygen Trim Controls	0.18	43.00	-	-	425	-	-	59.0	379	15,030	
5.3.2	Replace Burners	0.12	68.00	-	-	425	-	-	59.0	379	23,297	

Portsmouth Table 8.3
Summary of Recommended Energy Conservation Opportunities (ECOs's)

Summary of Recommended Energy Conservation Opportunities (ECO's)											
ECO No.	ECO Name	SIR	Simple Amortization Period (yr)	Electricity (kWh)	Annual Savings				Total Investment		
					Fuel Oil	Natural Gas	Total Energy	Cost			
									No. 2	No. 6	
			(yr)	(kWh)	(gal)	(gal)	(ccf)	(MBtu)	(\$)	(\$)	
5.3.9	Repair Steam Trap	63.18	0.29	-	-	6,705	18,470	-	3,695.0	19,943	5,157
5.3.8	Repair Steam Leak	27.64	0.66	-	-	2,314	6,865	-	1,344.0	7,254	4,287
5.3.6	Insulate Piping	27.35	0.67	-	-	4,036	7,356	310	1,692.0	9,334	5,594
5.4.4	Install High Effici.	10.12	1.30	2,742	-	-	-	-	9.36	210	248
5.4.3	Motors	5.54	2.30	91,489	-	-	-	-	312.3	7,045	15,157
5.3.7	Install Compressors	4.59	3.70	-	-	-	56,610	-	8,479.0	42,797	151,671
5.4.1	Provide Pump	3.68	2.80	9,087	-	-	-	-	31.0	700	1,741
5.3.5	Shut-off	3.46	4.90	-	-	838	7,580	-	1,266.0	6,553	30,881
5.3.1	Heat Recovery	2.67	5.40	-	-	17,110	57,491	1,496	11,129.0	59,555	684,486
5.4.5	Replace Boilers	2.46	5.40	1,638	-	-	-	-	5.58	126	608
5.4.2	Insulate CHW Piping	2.30	5.40	81,284	-	-	-	-	277.4	6,259	32,451
	Provide Free										
	Cooling Cycle										

9.0 PROJECTS IDENTIFIED

Based on the guidance from the Division of Engineering and Housing (DEH), Fort Monmouth, economically viable ECOs were grouped into the following projects for purposes of evaluation and preparation of Productivity Capital Investment Program (PCIP) funding documents. The following are the projects identified:

PROJECT NO.	ECO NO.	PROJECT DESCRIPTION
1. (QRIP)	5.3.6 5.3.8 5.3.9	Insulate Hot Piping Repair Steam Leaks Repair Steam Traps
2. (QRIP)	5.4.2 5.4.3	Provide Free Cooling Install Smaller Compressors
3. Recovery (QRIP)	5.3.5 5.3.7	Install Blowdown Heat Provide Summer Boiler
4. (ECIP)	5.3.1	Replace Boilers